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ABSTRACT

These highlights are based on mail responses to a National Science Foundation (NSF) inquiry to its Industrial Panel of Science and Technology, and interviews with other research and development (R&D) officials. Although it is not intended to be a statistically valid sample of R&D firms, NSF's Industrial Panel includes representatives from all major R&D-performing industries. Of the 84 companies contacted, replies were received from 58 firms, of which 46 conducted R&D abroad. These companies account for approximately 50 percent of R&D conducted overseas by U.S. firms. The 46 responding R&D directors discussed factors influencing their firms' decisions to engage in R&D activities abroad and provided projected changes in the growth of overseas R&D activities during 1983 and 1984. Findings are reported under these categories: characteristics of firms funding R&D abroad; trends in R&D funding; factors underlying the performance of R&D abroad; and outlook. Among the findings highlighted are those indicating that the U.S. R&D spending overseas will remain level in current dollars during 1983 and rise by approximately 7 percent in 1984 (provided certain assumptions are met) and that reasons for conducting R&D overseas were site-specific manufacturing/sales needs and opportunities to participate in scientific advances made in other countries. (JN)

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SCIENCE RESOURCES STUDIES HIGHLIGHTS

NATIONAL SCIENCE FOUNDATION WASHINGTON, D.C. 20550 DECEMBER 30, 1983 NSF 83-329

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Dollar Value of U.S. R&D Expenditures Overseas Declined in 1982

This report is based on mail responses to a National Science Foundation (NSF) inquiry to its Industrial Panel on Science and Technology, and interviews with other research and development (R&D) officials. Although it is not intended to be a statistically valid sample of R&D firms, NSF's Industrial Panel includes representatives from all the major R&D-performing industries.

Of the 84 companies contacted during February-April 1983, replies were received from 58 firms of which 46 conducted research and development abroad. These companies account for approximately 50 percent of research and development conducted overseas by U.S. firms. The 46 responding R&D directors discussed factors influencing their firms' decisions to engage in R&D activities abroad, and provided projected changes in the growth rate of overseas R&D activities during 1983 and 1984. Except where noted, the data and comments in this presentation are solely those of the R&D officials.

Highlights

- After increasing at an average annual rate of 16 percent between 1974 and 1980, the growth of the dollar value of U.S. company funding of research and development performed abroad came to a virtual standstill during 1981 at a level of $3.2 billion. Preliminary data for 1982 indicate a reduction in funding to approximately $2.9 billion.

- This abrupt change in the growth of the dollar value of U.S. company-funded research and development performed overseas was not attributed to a deemphasis of research and development, but, according to company officials, to the appreciation of the U.S. dollar relative to other currencies, and the recession-induced decreases in revenue from overseas production.

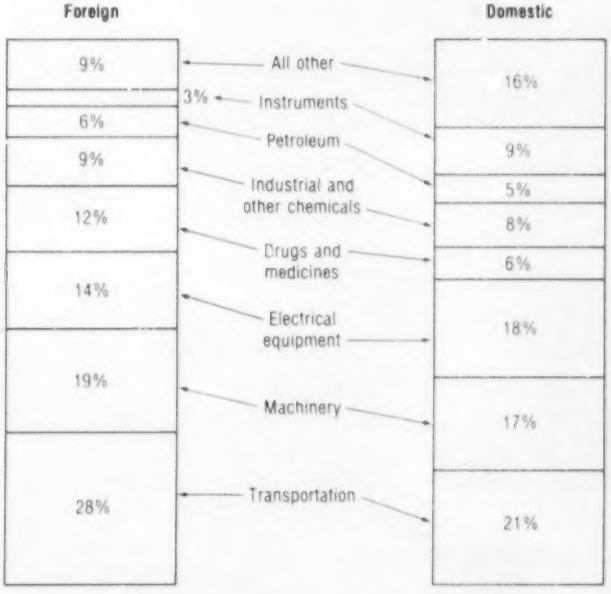
- It is estimated that U.S. research and development (R&D) spending overseas will remain level in current dollars during 1983 and rise by approximately 7 percent in 1984, assuming there is some decline in the value of the U.S. dollar from recent levels, and a continuation of the slow improvement in the economies of the major foreign industrial nations.

- Among the major reasons given by industry officials for conducting research and development overseas were site-specific manufacturing and sales needs and the opportunity to participate in the scientific advances made in other countries.

Characteristics of Firms Funding Research and Development Abroad

Data on company-funded research and development performed outside the United States by foreign affiliates of U.S. companies have been collected since 1974 in the National Science Foundation's (NSF's) annual Survey of Research and Development in Industry. Only a small fraction of U.S. companies engage in R&D activities overseas.[1] The Census Bureau, the collecting agency for the survey, estimates that in 1981 only 15 percent of U.S. R&D-performing firms conducted research and development abroad. These tend to be large companies with significant outlays for research and development; during 1981 they accounted for slightly more than half of all the company-funded research and development conducted in the United States. Industries which are the largest R&D performers within the United States also generally fund the most research and development abroad (chart 1).

Chart 1. Distribution of company-funded foreign and domestic R&D expenditures among major R&D-performing industries: 1981



SOURCE: National Science Foundation

Prepared in the Industry Studies Group, Division of Science Resources Studies

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Trends in R&D Funding Abroad

Between 1974 and 1980, funding for research and development performed abroad by U.S. firms increased at a faster rate than company-funded research and develoment performed within the United States. During that period R&D activities abroad increased over 140 percent from $1.3 billion in 1974 to $3.2 billion in 1980, reflecting in large part the growth of sales abroad. Company-funded research and development performed *within* the United States also grew, but at a slower rate, increasing 108 percent during the same period. This relationship changed markedly during 1981, however, when company R&D expenditures within the United States increased by 16 percent over 1980, while the growth in overseas R&D funding came to a virtual standstill. Preliminary figures reveal that research and development abroad declined approximately 7 percent in 1982.

NSF conducted a mail survey of firms in major R&D-performing industries to assess the current climate for research and development abroad, and to ascertain whether the abrupt changes in R&D funding reported in 1981 and 1982—namely, continued increase in domestic R&D expenditures combined with a drop in R&D funding abroad—reflect a new phase in industrial activity or merely a short-run deviation in the overall trends (table 1).

Replies from the R&D directors indicate that the motivations for U.S. firms to conduct research and development abroad continue to remain strong and that the reported recent decline in the dollar value of overseas research and development is sharply affected by the strength of the U.S. dollar. Also contributing to the decline is the fact that the worldwide recession, more severe in foreign countries than in the United States, forced many U.S. firms to curtail R&D activities abroad. The R&D officials emphasized that each company examines these factors and responds according to its specific goals; each is primarily influenced by prevailing conditions within the specific country of operation.

For example, the recession caused a slowdown in foreign R&D activity in those U.S. firms whose foreign affiliates independently fund their own research and development, since the recession-induced cut in overseas production generally caused a decrease in the affiliates' ability to fund and perform research and development. In contrast, other firms which allocate R&D projects among their facilities according to a central plan often have more flexible funding procedures and can maintain a more stable level of R&D activities

Table 1. Company research and development performed by foreign affiliates of U.S. domestic companies outside the United States by selected industry: 1974-81

[Dollars in millions]

Industry	SIC code	1974[1]	1975	1976	1977	1978	1979	1980	1981
Total	.....	$1,300	$1,454	$1,659	$1,877	$2,209	$2,754	$3,165	$3,157
Food and kindred products	20	27	23	29	32	43	51	54	66
Chemicals and allied products	28	208	269	312	332	395	500	603	651
Industrial and other chemicals	281-82,284-89	82	85	108	133	151	199	245	275
Drugs and medicines	283	126	184	204	199	244	301	357	376
Petroleum refining and related industries	29	[2]	[2]	[2]	[2]	[2]	[2]	141	192
Stone, clay, and glass products	32	7	7	[3]	[3]	[3]	[3]	21	15
Primary metals	33	3	9	12	9	9	11	11	9
Fabricated metal products	34	[2]	[2]	22	24	29	[3]	[3]	[3]
Machinery	35	258	331	352	411	460	534	599	585
Electrical equipment	36	238	245	278	300	352	445	451	455
Electronic components	367	4	7	9	13	17	25	29	47
Other electrical equipment	361-64,369	[3]	[3]	6	5	9	11	11	12
Radio and TV receiving equipment; communication equipment	365-66	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
Transportation	37	406	412	464	558	640	874	1,020	893
Motor vehicles and other transportation equipment	371,373-375,379	364	373	423	514	[3]	[3]	[3]	[3]
Aircraft and missiles	372,376	42	39	41	44	[3]	[3]	[3]	[3]
Professional and scientific instruments	38	39	49	49	51	61	76	86	101
Other manufacturing industries	21-27,30-31,39	111	105	137	144	181	213	139	147
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	3	4	4	9	12	5	7	12

[1] Based on data obtained from the top 200 U.S. R&D performing companies.
[2] Included in the other manufacturing industries group.
[3] Not separately available but included in total.

Note: Data are reported in current U.S. dollars.

SOURCE: National Science Foundation

overseas throughout a recession, independent of the level of sales.

When the U.S. dollar becomes strong relative to foreign currencies, making foreign R&D services less costly in U.S. dollars, U.S. firms have several options. One strategy involves making no adjustments in the firm's level of R&D activities overseas with a resulting smaller expenditure of U.S. dollars. Another strategy is to fund the same dollar amount for R&D activities overseas, usually by maintaining the same permanent level of R&D staffing, but temporarily increasing purchases of supporting services that have become less expensive in U.S. dollars. Finally, there are those firms which considerably increase the overall level of R&D performance overseas because of the comparative advantage of the lower dollar costs.

While all these forces affected U.S. firms' reactions to the impact of recession and currency changes, it is not possible to quantify the effect of the individual factors on the aggregate data, since data are not collected by individual country. In addition, the R&D directors queried were unable to quantify the relative magnitude of the impact of recession and currency conversion. They did, however, indicate that the currency rate changes seem to have a greater impact on the reported data than the recession.

Factors Underlying the Performance of Research and Development Abroad

Responses from the R&D directors reflect the varying degrees of involvement of U.S. firms in overseas research and development. The two extremes appear to be (1) those firms whose foreign subsidiaries conduct all the foreign R&D activities for the firm and are given complete latitude to fund, perform, or contract out their research and development without input from the parent company and, (2) those firms whose activities call for totally integrated worldwide R&D facilities, centrally planned by the U.S. company. Since most firms operate between these two extremes, it is not surprising that respondents offered a wide variety of motives for performing research and development abroad.

The most frequently cited reason, mentioned by over one-third of the respondents, was to provide direct technical support for sales and manufacturing facilities which are already located overseas. When a U.S.-developed product is manufactured abroad it often must be accompanied by on-site research and development to reformulate the product to accommodate the substitution of locally available raw materials. Other manufacturing-related factors requiring R&D efforts are the solution of problems specific to the geographic locale, or modification of products to conform to local customs and preferences.

Another important reason why U.S. firms conduct research and development abroad is that they can benefit from the growing scientific expertise in foreign countries. Twelve responding companies reported that a major benefit from their overseas R&D laboratories was the cross-fertilization of ideas and the different perspectives that foreign researchers contribute. Having an R&D facility in a foreign country often affords U.S. firms an opportunity to participate in scientific activities of that country. Six of the respondents reported that their companies were letting contracts with foreign universities and/or providing support to foreign university professors to enrich their technology in very specific fields of research activity.

Another major reason cited for pursuing research and development abroad is the availability of a large pool of scientific talent. There are shortages of some skilled labor in certain geographic locations in the United States, particularly in the computer software field. While this domestic shortage exists, the recession abroad has depressed the foreign market for software graduates, making well-qualified personnel available to U.S. companies overseas. The supply of software graduates is particularly strong since many overseas universities have recently been upgrading their software departments. (Software requires relatively low capital investment so that the overall cost of establishing outstanding centers is small compared to most other disciplines.)

In the interest of developing an increasingly skilled labor force, many foreign governments are requiring large corporations not only to manufacture locally and maintain development and technical services within the country, but also to conduct research projects utilizing local employees. Many countries also offer preferential pricing or tax incentives to induce foreign firms to make a commitment to undertake research and development locally.

Only three respondents specifically singled out lower costs (primarily labor costs) as a major factor in their decision to locate an R&D laboratory overseas. Several respondents mentioned that cost was only one of several factors taken into account in locating an R&D facility, and in fact, was never the primary factor. Tax provisions also were not considered major considerations, although at this writing there is no consensus on the impact that the R&D provisions of Treasury Regulation section 1.861-8 have on firms' decisions concerning the location of R&D facilities. This regulation requires that for U.S. tax purposes a certain proportion of R&D costs, regardless of where the work was actually performed, be attributed to foreign source income, thus reducing the foreign tax credit allowable under U.S. law. In some cases this increases the firm's total (domestic plus foreign) tax liability. Section 223 of the Economic Recovery Tax Act of 1981 (ERTA) provided for a 2-year moratorium of the regulation. After NSF's mail inquiry, the Treasury in June 1982 issued the results of its study recommending an additional 2-year extension of the present moratorium on the regulation, which would "...provide Congress with an opportunity to consider the findings of this report while Congress and the Administration work to develop a coherent national program of R&D incentives."[2]

Although the firms included in the NSF survey were not a statistically valid sample, it is interesting to note that the pharmaceutical and petroleum industries were the only major R&D-performing industries in which every company contacted reported involvement in some aspect of foreign R&D activity. These two industries have specific needs for R&D laboratories overseas. Many petroleum companies maintain large-scale foreign operations, and consequently find that development facilities are needed to solve site-specific problems. Drug companies claim that they cannot afford to develop and manufacture products to be sold only in one country because the cost of introducing a major medical product is so great. Consequently, these firms strive for worldwide markets, which, in turn, create a need for specialized R&D facilities overseas.

Pharmaceutical companies as well as other firms selling regulated products must also maintain R&D facilities in many countries to meet governmental requirements. An increasing number of countries are requiring that these products meet their own clinical and field-trial requirements before they can be sold, which necessitates the location of an R&D facility in that country.

Outlook

The R&D directors surveyed indicated that the major factors historically responsible for R&D growth abroad are likely to remain significant in the near future. As the worldwide economy improves many U.S. firms anticipate being able to revitalize and expand their overseas markets, and the resultant need for R&D activities overseas will also increase. Larger firms are expected to increase R&D activity abroad to participate in the scientific advances of foreign scientists and it is also likely that foreign governments will continue to require large nonindigenous firms to maintain local production and research facilities within their countries. The short-term rate of increase of R&D spending abroad in dollars, however, is projected to be slow, with current-dollar expenditures remaining level in 1983 and rising slightly in 1984. These estimates are based on the assumption of some decline in the value of the U.S. dollar, and the continuation of the slow improvement in the rate of recovery of the world economy.

Although the factors listed above indicate a future growth in U.S. funding of research and development overseas, there are also other considerations that make estimates of short-term changes in R&D activities overseas particularly difficult at this time. For example, several survey respondents reported that they believe that some foreign countries are imposing sanctions that may dampen the growth rate in overseas R&D funding. Onerous price and tax restrictions were specifically cited; these respondents indicated that some firms are closing, or may be forced to close, their facilities in such countries. Another factor clouding the ability to estimate the growth of R&D funding overseas is that inflation in many countries, particularly in Latin America, is causing havoc with spending policies.

An additional factor creating difficulty in estimating the future growth of R&D expenditures overseas is the phenomenon of joint R&D ventures between a U.S. firm and a foreign company. Although not specifically asked of the panel, seven respondents mentioned this area as one of great and growing importance in future R&D activities. In a typical joint venture two firms undertake an overall project, and each partner performs its allotted segments at its own expense and in its own locations. In the new joint R&D ventures currently evolving, the U.S. firms' contributions are generally being performed in American facilities, and are reported as part of domestic spending. It remains to be seen whether future joint-venture activities with foreign firms will grow sufficiently to affect the overall proportion of research and development abroad as a percent of total R&D expenditures of U.S. multinationals.

Footnotes

[1]For a more detailed discussion of the factors influencing U.S. firms to conduct research and development overseas, see National Science Foundation, "U.S. Industrial R&D Spending Abroad," *Reviews of Data on Science Resources*, No. 33 (NSF 79-304) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, April 1979).

[2]Department of the Treasury, *The Impact of the Section 861-8 Regulation on U.S. Research and Development* (Washington, D.C., June 1983), p. 34. For additional discussion of the effects of the Regulation, see Anita Benvignati, *Impact of American Tax Policy on the Level and Location of Industrial Research and Development* (Washington, D.C.: Department of Commerce, 1982). See also a study commissioned by the National Association of Manufacturers et. al, *National Research and Development Study* (Washington, D.C.: Arthur Andersen & Co., 1983).

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